

Progress in the International CLIVAR C20C+ Detection and Attribution Project

<http://portal.neresc.gov/c20c>

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Current model products not designed for studying extremes under a changing climate

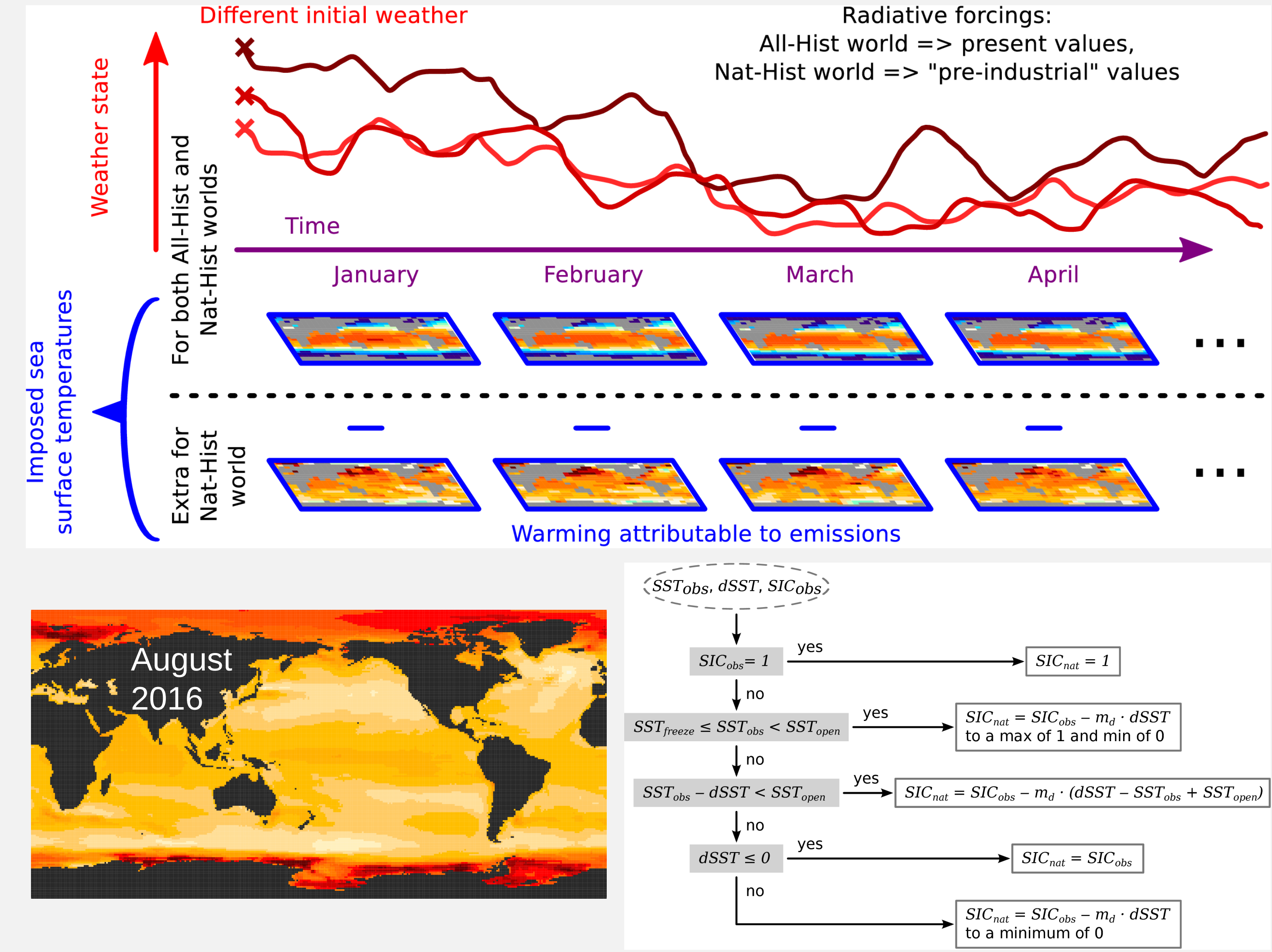
The emerging field of event attribution aims to estimate the degree to which anthropogenic emissions have contributed to recently experienced extreme weather events.

NEED FOR PRODUCT THAT:	C20C+ D&A
Allows characterization due to model design	Uses multiple climate models
Allows characterization of uncertainty due to experiment design	Includes data for trend analysis and factual-counterfactual analysis, with multiple planned counterfactual estimates
Provides good sampling of rare extremes	Includes large initial-condition ensembles
Provides reliable representation of extremes	Uses observed ocean temperatures, atmospheric models at higher average spatial resolution than e.g. CMIP5
Facilitates rapid analysis of extremes	Publishes simulation output on a public portal

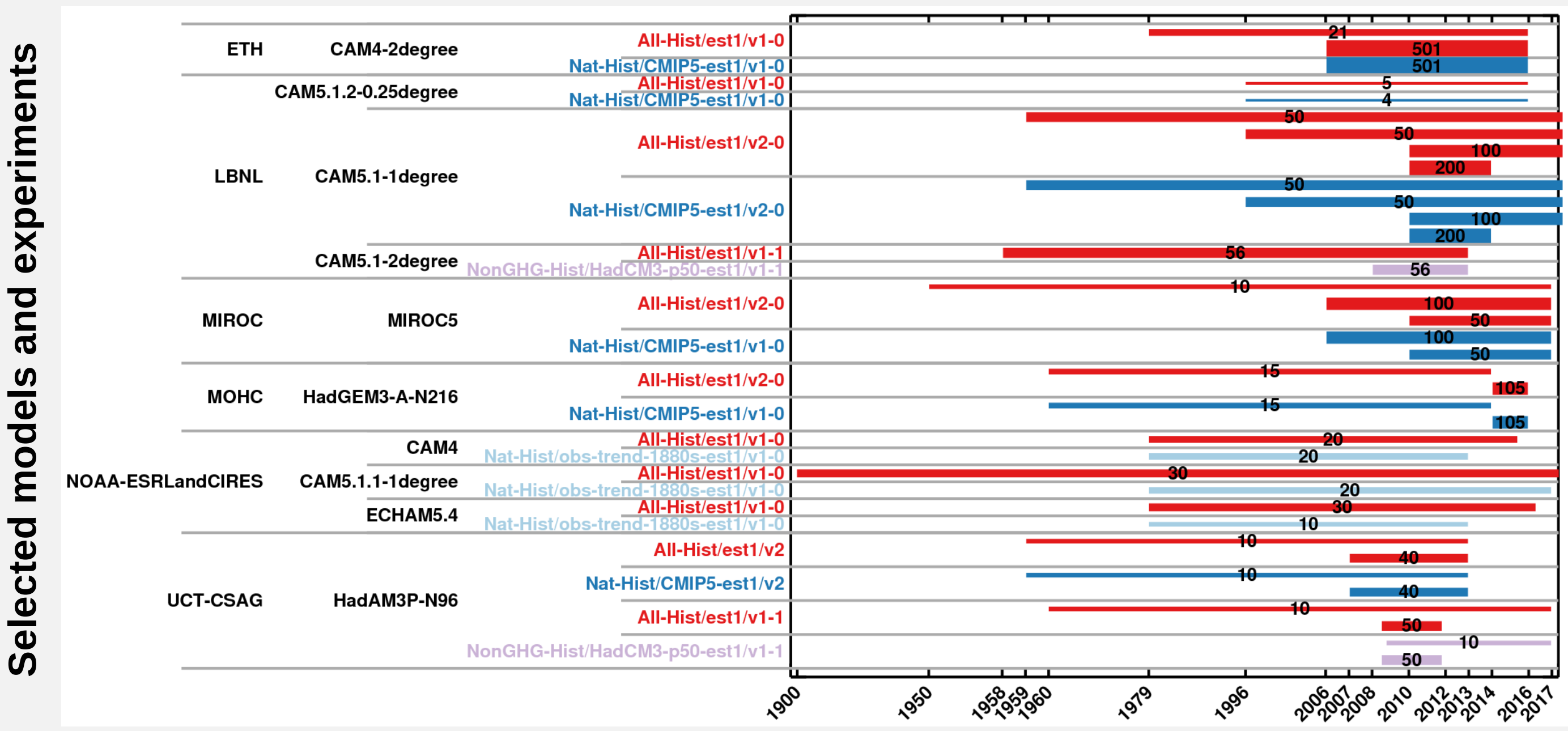
Experiment design

Run a large number of simulations of atmospheric models:

- **Of the factual “real world” (All-Hist)** that we have experienced
 - Observed changes in radiative, land surface, and ocean surface conditions
- **Of the counterfactual “world that might have been” (Nat-Hist)**
 - Anthropogenic forcings set to year 1850 values
 - Ocean and sea ice adjusted according to warming attributable to emissions
 - Explore different estimates of ocean cooling



International collaboration



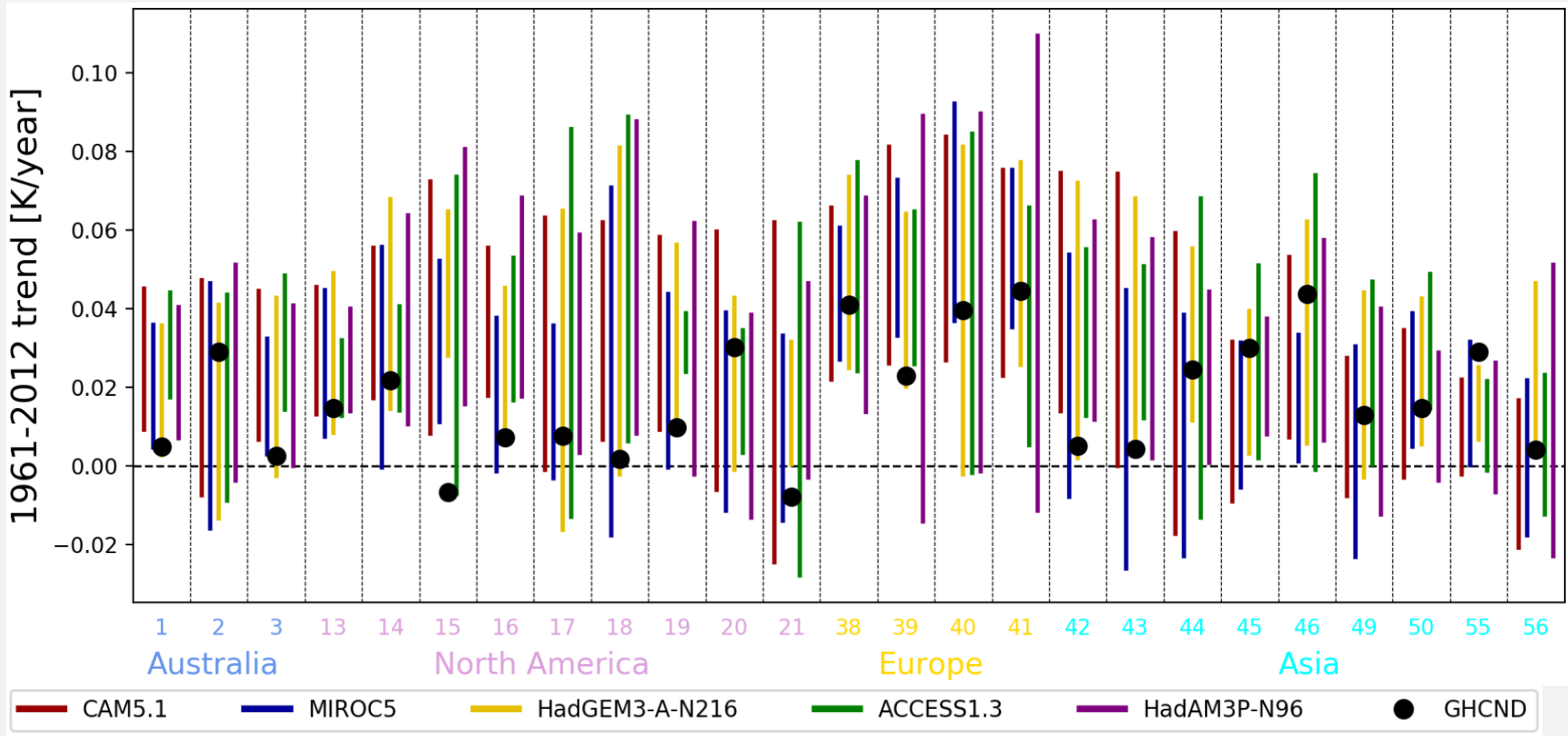
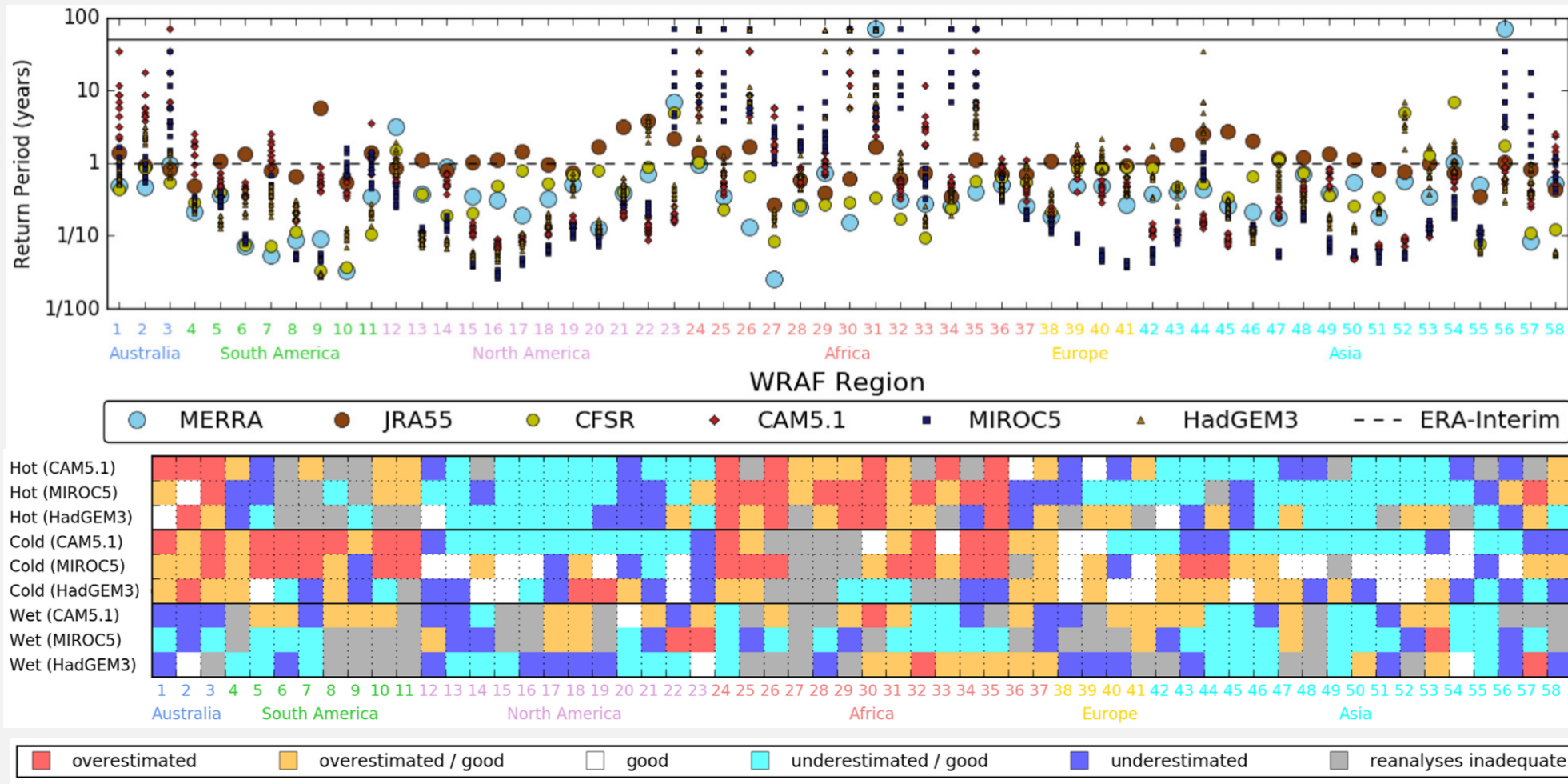
Currently 380TB of output published, PB pending...

- **Portal services by National Energy Research Scientific Computing Center**
 - <http://portal.neresc.gov/c20c/data.html>
- **Additional online analysis services by NOAA-ESRL and CIRES**
 - Selected monthly output at <http://www.esrl.noaa.gov/psd/repository/alias/facts>

Comparison with observationally-based products

Return periods of ERA-INTERIM 1-in-1-year hot day return value over WRAF-v3.0 2Mm² regions

- In many regions models lie outside of spread of reanalyses
- But in many regions spread of reanalyses lies outside of spread of models
 - Reanalyses inadequate for evaluation



Trends in annual TXX over WRAF-v3.0 2Mm² regions

- TXX=annual max of daily max temperature
- Model trends may be too large in some regions
- Observational uncertainty not clear
- Many regions with insufficient observations

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